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Practitioner's Docket No. 3293.004A ***PATENT***

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Ruggero M. Santilli	)	
	)	
Application No.: 09/826,183	)	Group No.: 1714
	)	
Filed: 04/04/2001	)	Examiner: C. D. Toomer
	)	
For: NEW CHEMICAL SPECIES OF CLUSTERS	)	

DECLARATION UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Erik Trell, declare and state:

1. I am a scientific professional who has reviewed the works of Dr. Santilli as it relates to the principles embodied in the new chemical species of clusters.

2. My curriculum vitae is attached herein.

3. I have read the Official Action mailed February 13, 2006, and the reasons for rejection noted by the Examiner. In order to provide evidence of universal acceptability and applicability, I provide the following comments in the same order as those of the examiner concerning my independent observation of the invention claimed by Dr. Santilli and/or my understanding of the new species of clusters.

4. This I will do in relation to a recent highly qualified large-scale scientific/industrial project plan in Norway, which holds a world-leading position in involved fields. The objective at hand is Carbon Dioxide recycling where clusters are highly productive both in process and output; in practice amply documenting that contrary to the examiner's statements there are effective enablement, operability, utility, let alone acceptance of the invention both scientifically and industrially.

The project's background is posed (*from the project description*) "by the environmental problems related to global warming, believed to be caused by the increased emission of greenhouse gases (GHG), especially Carbon Dioxide that accounts for 77 percent of the world's total GHG emissions....increased from about 2.5 billion tons to 5 billion tons from 1900 to 1950. In 2004 the volume is well above 25 billion tons. Further, the predictions of Carbon Dioxide production in the near future are far from reassuring. Rather than decreasing, the forecasts estimate a significant increase, as long as fossil fuels remain a the main source for power and electricity production....there are many different strategies trying to remedy this alarming environmental situation...(but)...so far these separation installations are large and expensive, and only feasible under specific conditions", whereas the "project advances a radically new approach to CCS, however, with full possibility of integration. Groundbreaking scientific achievements in mathematics and the hadronic sciences led to the prediction and experimental verification of the new chemical species.....bound together by a contact force in the so-called iso-electron (Cooper pair), presenting many interesting attributes and highly promising possibilities for 'ecological technologies'....with a wide range of applications in relation to new clean energies and fuels".

Against this established background, the implementation focus is to: "a. Mobilize the best knowledge from the scientific field of Hadron Mechanics, and b. couple it with SINTEFs (*Norway State Natural Science and Technological Research Institute*) research on Carbon Dioxide handling, containing our internationally leading research groups on Carbon Dioxide capture, transport and storage, gas technology and chemical process technology".

From this and other projects and sources, it is evident that the examiner's general statement on Page 2 that the "disclosed invention is inoperative and therefore lacks utility" is wrong, and lacks substantiation. The given argument on page 3 that "it is clear from known principles of physics and chemistry that the instant compositions cannot exist according to conventional theory" clearly refers to the prior art quoted in the preceding paragraph of the application, and ignores the next section in this that "only when a gas is forced to pass at high pressure through a restricted area surrounding an electric arc of a PlasmaArcFlow Reactor of the present invention can the chemical species of clusters be produced in which a chemical species of molecules is turned into an essentially pure population of clusters". A new invention virtually by definition extends "conventional theory", so, in fact, the examiner's conclusion is doubly misleading, as is his overall vindication so decisive for the ensuing rejections that "no assertions of such a population of clusters have been recognized or verified by the scientific community". He extracts a diametrically opposite corollary from the quoted passage, fails to show any reference supporting his allegation, and neglects ample presented experimental evidence as well as qualified recognition, e.g., by prominent national organs like SINTEF.

The further rejection on page 3 and 4 "as failing to comply with the enablement requirement" obviously falls for the same aforesaid reasons and facts, and this continues to apply in the ensuing detailed considerations on "undue experimentation":

(1) *The breadth of the claims*; Inoperability and lacking enablement arguments manifestly wrong.

(2) *The nature of the invention*; Total lack of substantiation by the examiner that "the vast majority of the scientific community has held the belief that a population of clusters that are detectable via peaks in mass spectrometry but not by IR or UV spectrometry is not attainable". And firstly: "has held" is in the past, secondly: a "belief" is not scientific, thirdly: legitimate references of the proffered kind are lacking and, fourthly: all experimental and other evidence as well as ample recognition and enablement by leading instances, like SINTEF, are in direct contradiction to the examiner's inferences.

(3) *The state of the prior art*; One wishes to remind the patent examiner that a new invention by necessity transcends prior art. As a scientist I have, with respect, to report that I find the examiner's reasoning here paradoxical.

(4) *The level of one of ordinary skill*; This is innuendo, again devoid of substantiation and reference, and can not, if anything, have other ground than hearsay since it is quite against the very empathy and accent of true Science and Scientists as well as what, as only to small extent here summarized, has already been recognized, enabled and implemented in reality.

(5) *The level of predictability in the art*; Ditto

(6) *The amount of direction provided by the inventor*; It has certainly been enough to enable e.g. SINTEF and many other prominent artisans and organs, and the applicant's

provision of "specific process steps" are explicit to the extreme degree of ready apparatus.

(7) *The existence of working examples and (8) the quantity of experimentation needed to make use of the invention*; See above. The examiner refers to "the time the invention was made" and since then much has happened which makes the examiner's objections obsolete and erratic. In actual fact, there is a growing widespread acceptance in the most qualified scientific circles of Professor Santilli's quintessential findings as manifested, for instance, in the positive review already in the beginning of this first decade of the third millennium in the renowned forefront *International Journal of Hydrogen Energy*; putting it's eminent seal of recognition and approval by the printing. One is intrigued by the examiner's aims and motivation and cannot avoid the feeling of bias and/or evasion. He ends his report somewhat wantonly quoting that "a patent is not a hunting licence". No, but neither is an invention a sitting prey, but a lawful subject holding the highest prospect and promise of progress and prosperity in a grand Nation such as U.S.A. renowned for always supporting and promoting actual merits and potential in accordance with the liberal spirit and accord of its noble constitution, aspirations and civil rights alike. Inventions are the very substrate for this advancement and entitled to a careful digestion instead of careless rejection in the accountable Office.

Dated: 10/7 2006

Erik Trell

Declarant - Erik Trell

CURRICULUM VITAE

Erik Trell, Born 4th of June 1939 in Trollhättan, Sweden. Married, two children.

Started medical studies in Uppsala 1960. M.D. 1967 at the University of Lund, Ph.D. Dissertation (on Pulmonary Hypertension) 1972 at the Medical Department, Malmö General Hospital, University of Lund (Chief and Tutor Jan Waldenström). Docent in Internal Medicine the same year there. Specialist degrees in Internal medicine and Cardiology 1971, and in general medicine 1984.

Resident S:t Lars Hospital Lund (Psychiatry) 1964-67, and Malmö General Hospital Hospital, Department of Internal Medicine 1967-72 and Endocrinology 1972-73.

1973 – 1982 Associate Professor and Chief, Department of Preventive Medicine, Malmö General Hospital, 1982 – 1983 Research Fellow Swedish National Association against Heart and Chest Diseases, 1983 – 1987 Associate professor in General Medicine at the Department of Community Medicine in Malmö, Lund University. Since 1987 Professor in General Medicine and Chief, Department of Primary Health Care and General Practice, Faculty of Health Sciences (Hälsouniversitetet), University of Linköping.

Advisory functions within WHO and International Agency for Research on Cancer. Author and co-author of c:a 300 articles in peer-reviewed medical scientific journals (c:a 150 of them retrievable via PubMed: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed) and in addition c:a 200 congress papers, abstracts, book chapters etc.; in the 70's and 80's mostly within Cardiology, Diabetology, Alcohol Diseases, Cancer and Preventive Medicine, currently mainly in General Medicine, Medical Computing and Informatics, Health Policy and Health Systems Research, with international consulting and tutorial assignments also internationally, mainly in Greece, the Balkans and India . I enclose here the two latest pages in my reference list.

The medical research has involved a number of early/innovative achievements, first in Clinical Medicine, then with the comprehensive Department of Preventive Medicine in Malmö including e.g. alcohol intervention, mammography and for the time pioneering on-line computer system, and in later years by development of interactive media based health screening and monitoring programmes (e.g. "Healthometer"), and health policy implementation both globally (WHO Regions for Health Network) and locally (e.g. county of Östergötland and Crete).

Studies in Physics and mathematics were catalysed by attempts of applying Lie group and algebras to (rotational) electrocardiography representation, and have then developed separately and in increased collaboration with the Institute for Basic Research as well as the Calcutta Mathematical Society and other organs. The aim is to complement theoretical knowledge and insights with real structural rendering enabling further exploration and understanding by nanotechnological methods.

I here enclose the last page of my medical reference list, plus a list of physical/mathematical publications. More specifically I refer to my book review in the international Journal of

Hydrogen energy on Professor Ruggero Maria Santilli's book "Foundations of Hadronic Chemistry with Applications to New Clean Energies and Fuels" (Available online at www.sciencedirect.com International Journal of Hydrogen Energy 28 (2003) 251 – 253 www.elsevier.com/locate/ijhydene).

(Latest page in medical reference list):

488. A 161. Lorentzson B, Trell E. Introducing the theme in a qualitative interwiew using a visual starter. WONCA Wien, 2000.

489. A 162. Chatziarsenis M, Lionis C, Faresjö T, Borgqvist L, Trell E. Looking on the perspective of a Hospital-Primary Health Care Institution after a Swedish-Greek thesis. WONCA Wien, 2000.

490. A 163. Lionis C, Thireos EA, Koutis A, Vitsaxaki M, Tseliou E, Trell E. Developing primary health care services for University students: experiences gained from the Uni-Versity of Crete, Greece. WONCA Wien, 2000.

491. A 164. Theodorakis P, Lionis C, Seniorou M, Kosta J, Trell E, Glaros D. Primary health services is Southern Albania: Current situation and perspective. WONCA Wien, 2000.

492. A 165. Lindén G, Mengel AC, Trell E. Identification of pre-analytical errors in a laboratory service unit. Int. Lab. Conference, Vancouver, 2000

493. A 166. Thireos E, Lionis C, Trell E. Assessing the students' health status: Experiences gained from the university of Crete, Greece. 6th Mediterranean Medical Congress, Malta, September 2000.

494. A 167. Trell, E. Temporospatial Transition – Back to Go. Physical Interpretations of Relativity Theory VII, London: 15-18 September, 2000.

495. A 168. Theodorakis PN, Benton JI, Anderson JP, Glaros D, Trell E, Lionis C. A comparative study of two Primary Health Care practices on the Greek-Albanian border. European General Practice Research Workshop, Zagreb, Croatia, 19-22nd October, 2000.

496. S 276. (p) Lionis C, Vlachonikolis J, Chatziarsenis M, Faresjö T, Kristjansson I, Tzagournissakis M, Plaitakis A, Trell E. Managing Alzheimer's Disease in Primary Care in Crete, Greece: Room for Improvement. Quality Management in Health Care 9(2), 16, 2001.

497. S 277. (p) Chatziarsenis M, Makri E, Sapouna-Chatziarseni W, Fioretos M, Faresjö T, Trell E, Lionis C. Care Preferences in a Cretan Community with Integrated Hospital/General Practice Services. International Journal of Health Care Quality Assurance 14, 189, 2001.

498.	S 278. (p)	Glaros D, Lionis C, Qiqi H, Theodorakis PN, Trell E. Health Care in Albania: what of the future? Lancet 357, 1047, 2001.
499.	S 279 (p)	Theodorakis PN, Rrumbullaku Ll, Glaros D, Lionis C, Trell E. "Gröna öar" för Balkansk Primär vård? Läkartidningen 98, 2747, 2001.
500.	S 280.	Rrumbullaki L, Theodorakis PN, Caca P. Lionis C, Trell E. (p) Medical education in Albania: current situation and perspective, with reference to primary care. Croat Med J 43, 50, 2002.
501.	S 281 (p)	Rrumbullaki L, Theodorakis PN, Pulluqi P. Lionis C, Trell, E. Postgraduate training in family medicine in Albania. Postgrad Med J 78, 308, 2002.
502.	S 282 (v)	Trell E. Från Fammi till Falli. Läkartidningen 100, 3353, 2003.
503.	S 283 (p)	Mantzavinis G, Theodorakis PN, Lionis C, Trell E. [Geographical inequalities in the distribution of general practitioners in Sweden.] Läkartidningen 100, 4294, 2003.
504.	S 284 (p)	Roel E, Faresjö Å, Zetterström O, Trell E, Faresjö T. Clinically diagnosed childhood asthma and follow-up of symptoms in a Swedish case control study. BMC Fam Pract 6, 16, 2005
505.	S 285 (p,v)	Lionis C, Thireos E, Antonopoulou M, Rovithis E, Philalithis A, Trell E. Assessing university students' health needs: lessons learnt from Crete, Greece. Eur J Publ Health 16, 112, 2006.
506.	S 286) (p,v)	Theodorakis PN, Mantzavinis GD, Rrumbulllaku L, Lionis C, Trell E. Measusing health inequalities in Albania: a focus on the distribution of general practitioners. Hum Resour Health 4, 5, 2006.

Physical publications:

Trell, E. [1980]: 'A Calculation of the Electron Circular orbital radius', *Speculations in Science and Technology,* **5**, pp 533-5.

Trell, E. [1983]: 'Representation of particle masses in Hadronic SU(3) diagram', *Acta Physica Austriaca,* **55**, pp 97-110.

Trell, E. [1984]: 'Scheme for a time antenna in three-dimensional Hausdorff space', *Speculations in Science and Technology,* **7**, pp 269-77.

Trell, E. [1990]: 'Geometrical Reproduction of (u,d,s) Baryon, Meson, and Lepton Transformation Symmetries, Mass Relations, and Channels', *Hadronic Journal,* **13**, pp 277-97.

Trell, E. [1991]: 'On Rotational Symmetry and Real Geometrical Representations of the Elementary Particles With Special Reference to the N and Δ Series', *Physics Essays,* **4**, pp 272-83.
Trell, E. [1992]: 'Real Forms of the Elementary Particles with A Report of the Σ Resonances', *Physics Essays,* **5**, pp 362-73.
Trell, E. [1997]: 'An alternative solution to Fermat's Last Theorem: Infinite ascent in isotopic geometry', *Hadronic Journal Supplement,* **12**, pp 217-240.
Trell, E. [1998a]: 'Isotopic proof and reproof of Fermat's Last Theorem verifying Beal's Conjecture', *Algebras Groups and Geometries,* **15**, pp 299-318.
Trell, E. and Santilli, R.M. [1998b]: 'Marius Sophus Lie's Doctoral Thesis Over en Classe Geometriske Transformationer', *Algebras Groups and Geometries*, **15**, pp 395-445.
Trell, E. [1998c]: 'The Eightfold Eightfold Way: Application of Lie's True Geometriske Transformationer to Elementary Particles', *Algebras Groups and Geometries*, **15**, pp 447-71.
Trell, E. [1999]: 'Real Charm of Form - Real Form of Charm. Duality in transition. In: *(Gill, T., Liu, K., Trell, E., Ed.s), Fundamental Open Problems in Science at the End of the Millenium*, pp. 1-29, Palm Springs: Hadronic Press.
Trell, E. [2000]: 'The Eightfold Eightfold Way. A Lateral View on the Standard Model'. *Physical Interpretations of Relativity Theory (11-14 September 1998), Late Papers, London: British Society for the Philosophy of Science* , pp. 263-84.
Trell, E. [2003a]: 'Book Review: Foundations of Hadronic Chemistry with Applications to New Clean Energies and Fuels', *International Journal of Hydrogen Energy*, **28**, pp 251-3.
Trell, E. [2003b]: 'String and Loop Quantum Gravity Theories Unified in Platonic Ether. With Proof of Fermat's Last Theorem and Beal's Conjecture'. In: (Ed.s) Duffy MC, Gladyshev VO, Morozov AN. *Proceedings of International Scientific Meeting PIRT -2003,* Moscow 30 June – 03 July, 2003, Bauman State University, Moscow, Liverpool, Sunderland, pp 134-49.
Trell, E. [2003c]: 'Original Diophantine equations lodge BC without ABC' *International Symposium on Recent Advances in Mathematics and its Applications (ISRAMA 2003), Proceedings, Calcutta: Calcutta Mathematical Society.*
Trell, E. [2004a]: 'Original Diophantine equations lodge BC without ABC', particles', *Review Bull. Cal. Math. Soc.,* **12**, pp. 29-54.
Trell, E. [2004b]: 'Tessellation of Diophantine Equation Block Universe'. *Physical Interpretations of Relativity Theory VIII (6-9 September 2002), Proceedings, London: British Society for the Philosophy of Science*, pp. 585-601.
Trell, E. [2004c]: 'Classical 3-d. Geometrical 'Vortex Sponge World-Ether Provides Natural Quantum Cavity Elementary Particle Standing Wave Incubation and Original Diophantine Equation Encapsulation'. *Physical Interpretations of Relativity Theory IX (3-6 September 2004), Proceedings, London: British Society for the Philosophy of Science*, pp. 503-30.
Trell, E. [2004d]: 'Cubit Isounits 'Tread a Daunting Path to Reality' While Proving Fermat's Last Theorem and Beal's Conjecture', *Hadronic Journal,* **26**, pp. 237-71.

Trell, E.[2004e]: 'Temporospatial transition – Back to go'. *Physical Interpretations of Relativity Theory (15-18 September 2000), Late Papers, London: British Society for the Philosophy of Science*, pp. 305-11.
Trell, E. [2005a]: 'Invariant Aristotelian Cosmology: Binary Phase Transition of the Universe from the smallest to the largest scales', *Hadronic Journal,* **28**, pp. 1-42.
Trell, E. [2005b]: 'An excursion in curvature I. Diophantine equations get real again in re-established flat Euclidean space', *Bull. Cal. Math. Soc.*, **97**, pp. 509-30.
Trell, E. [2005c]: 'An excursion in and betweem curvature II. From classical Lie algebra neighbourhood to QED and QCD of real elementary particles', *Bull. Cal. Math. Soc.*, **97**, pp. 509-30.

Book review

Foundations of hadronic chemistry with applications to new clean energies and fuels
R.M. Santilli; Kluwer Academic Publishers, Boston, Dordrecht, London, December 2001, ISBN 1-4020-0087-1

Erik Trell

Linköping University, Linköping, Sweden
Available online 10 April 2002.

Everything has a history—or two. When reviewing a pioneering treatise like the Italian–American phycisist Ruggero Maria Santilli's ground-breaking monograph, "Foundations of Hadronic Chemistry With Applications to New Clean Energies and Fuels", some epistemological reflections would seem to be extra warranted because of its virtual backwards-to-the-future renaissance of Physics, Chemistry and Mathematics as equivalent powers in the synopsis. A serious scientific dilemma nowadays is otherwise that the latter discipline has seized supreme command and that, as stated by William M. Honig [1], the ruling mathematical doctrine "since the 1920s? has had a stultifying effect on developments in physics".
This is not how it used to be, when Nature directed. It is of course a primordial conception that Existence springs from a synthesis of opposites/adjacents, like in the Nordic Mythology, where life whirls in the thin tempered interstice (Ginnungagap) between the outer, rectilinear, openly infinite deep-frozen darkness of Nilfeheim, and the inner, blazing, lighting-fast rotating, closely infinite fire-ball of Maspellsheim [2]. Even earlier, for instance, as expressed by the Yin-Yang symbol, a similar process was apprehended in the Orient of a spiraling transition between the complementary endless forms of Straight contracting into Round, the immense collective difference of which at the Cosmic level after long-winded journey (it is tempting to infer) disperses everywhere over the surface of the perfect sphere as the last decimal of π. In consequence, and with pronounced bearing to the mathematics which Professor Santilli has disclosed, there is inherent motion in this projection because the realisation comprises its own automatically congruent infinitesimal operator, or iso-unit.

Analogously it applies to the ancient Greek—but vice versa. They "are famous for a completely brilliant idea, namely, to use spatial images to represent numbers", where, however, "Euclid's Mathematics was closely associated with his concept of the world, which in accordance with Aristotle was that the Universe is enclosed in a sphere, in the interior of which space and the bodies full-fill the properties of Euclidean Geometry" [3]. So, in the Occident, Mathematics came to assume a perspective, falling from the vaulted firmament to the straight line and ultimately the vanishing intersection point as irreducible reference and elements. This orthogonal architecture of Western Mathematics where the static terms do not supply any kinetics (but a transcendental First Cause provided primum movens) persisted also after the Arabs replaced implicit figures and explicit constructions with algebraic letters and arithmetics, as can be seen, e.g. in the epoch-making doctoral thesis of Marius Sophus Lie, Over en class geometriske transformationer [4], from the English translation of which [5] the following is quoted:
"The Cartesian geometry, namely, translates any geometric theorem into an algebraic one and thus of the geometry of the plane renders a faithful representation of the algebra of two variables and likewise of the geometry of space a representation of the algebra of three variable quantities" ... "the geometrical transformation that is founded upon the Poncelet–Gergonne reciprocity can be perceived as consisting of a transition from a point to a straight line as element" ... "The in the following presented new theories are founded upon the fact that one can choose any space-curve which depends upon three parameters as the element of the space" ... "each point in space ... is associated with a cone, namely, the collection of tangents ... that go through the point in question" ... "A partial differential equation of the first order between x ,y,z is ... equivalent to ... finding the general surface which in each of its points touches a cone associated with the point in question ..."
Now, Lie revolutionised the mathematical comprise and compass by expanding these operations back to spherical and related geometries and clarifying the sets of continuous transformation groups deployable in and between them. But the inherited defect persists in the cores of the functions, that their constituent lines and points are left without. When Nanotechnology at all fronts is now approaching the genuine footing of tangible reality, it discontinuously halts at the very threshold where the elementary particles substantially enter: what are they, and how are they? It is comparatively more and more surrealistic to accept them as primarily mechanical points/packets/waves rigidly oscillating/amorphously radiating in and from disparate ready-made quantum cavities as they were provisionally once depicted 50–100 years ago. It is true that spectroscopical observations soon necessitated inside arrangements but (the neighbourhood versions of) the established algorithms governed the re, too, to quark and their orbits, partial charges and masses, fluxing gluons and so on.
The resulting inconsistencies are large and profound and actually the pragmatic impulse and reason; the effective white spot for Professor Santilli's exploration, in this case the chemical aspect of the panorama. And here I think we need to ask also ourselves as readers: are we yet true scientists, open-minded, bold, curious as our vocation prescribes? Do we still delight in breaking new grounds—and taboos, above all those founded on superstition or prejudice or routine?
Refreshed blood, moreover, is getting a survival condition for scholarly Science, left astern by industrial and military research in a situation when bright young Chemistry as well as Physics graduates rather seek their fortune there or on Wall Street than join the increasingly ecclesiastical promotion ladders at dogmatically inveterate Academia. Indeed, given sufficient talent, there is nothing to stop the endeavor that Professor Santilli has undertaken. On the contrary, the

facultative merit of his findings is that they are not only compatible with, but contributing to Quantum Chemistry and Mechanics, filling vital gaps that just lie beyond the definitions of these at a domain where they simply do not comply.
Professor Santilli initially identifies some of the major Quantum Chemistry shortcomings which can be resolved by his structural generalisation—covering under the name of "Hadronic Mechanics and Chemistry":
(1) lack of exact representation of molecular data (on binding energies of the order of 2%, and bigger deviations for electric and magnetic moments which are at time wrong even in their sign);
(2) inability to permit accurate thermochemical calculations;
(3) the absence of an attractive valence force sufficiently strong to explain the strength of molecular bonds actually existing;
(4) the inability to restrict valence bonds to electron pairs only;
(5) the prediction that all molecules are paramagnetic;
(6) and others
This accomplishment originates from the deduction that, unlike in local, linear and potential Quantum Mechanics and Chemistry, the novel "Santilli valence force" is non-linear (in the wavefunction), non-local-integral (over a volume), and of contact-non-potential type due to the deep overlapping of the wavepackets of valence electrons in singlet coupling. It is based on a new Mathematics, today known as "Santilli Isomathematics", with invariant real-valued, nowhere singular, yet arbitrary integro-differential units at all levels, from numbers to Schroedinger equations. The representation thus assures the invariance of the theory.
In short, he sets dynamics into realisation by isotopic operators not only enabling running transforms of conventional theories but also exposition of hidden variables, a generalization of Bell's inequality and a completion of Quantum Mechanics and Chemistry much along the celebrated argument by Einstein, Podolsky and Rosen of 1935. The "catastrophic inconsistencies of conventional Mathematics" in these and other respects are reviewed, including lack of invariance in time of basic units and numerical values with consequential lack of applicability to measurements, absence of preservation of Hermiticity with consequential absence of observables, violation of causality and probability laws as well as the basic axioms of Special Relativity. The elimination of such defects by Santillis Isomathematics should be most instructive reading for all true scientists. The new methods are specifically described for the study of molecular structures conceived as reversible systems isolated from the rest of the universe with Hamiltonian and non-Hamiltonian internal effects, and are presented as part of the "isotopic branch of Quantum Mechanics and Chemistry".
In addition, the first known invariant formulation of irreversibility at any level, from classical to operator systems is presented, founded upon Lagrange's and Hamilton's legacy of representing irreversibility by the reintroduction of those external terms in their celebrated equations which have otherwise been removed from the analysis throughout virtually the entire 20th century. By stating the retrieved "true analytic equations" in a corresponding form, Professor Santilli establishes a Lie-admissible structure in the sense of the American mathematician A. A. Albert. This is then extended from the classical to all subsequent levels of treatment, including quantisation and operator formulations. In this way irreversibility emerges as originating from the most elementary levels of nature (such as protons and electrons in the core of a star), thereby demonstrating the known impossibility of reducing a macroscopic irreversible classical system into a finite collection of elemen tary particles, each of which, as in Quantum Mechanics, is postulated to be in reversible condition.

Here, an additional new mathematics enters the exposition, today known as "Santilli Genomathematics" and characterised by two real-valued and nonsingular, yet nonsymmetric, generalized dynamic units interconnected by Hermitean conjugations, one of which is designated to move forward in time and the other to move backward in time. The differences between these basic units then guarantees irreversibility for all other reversible Hamiltonians. By recalling that all known potential interactions are strictly reversible, these nonsymmetric generalized units (known as "Santilli genounits") represent the interactions responsible for irreversibility, namely, Lagrange's and Hamilton's external terms, and are especially exemplified in the monograph as part of the "genotopic branch of Hadronic Mechanics and Chemistry" for an invariant representation of open irreversible processes, such as chemical reactions.

The book continues with an account of a third extended generalisation-covering Quantum Mechanics and Chemistry based on an even more general new Mathematics, today known under the name of "Santilli Hypermathematics," which is characterised by "multi-valued", real, non-singular and non-symmetric generalised units at all levels of study.

The need for the further generalization is shown by the concrete example of growth in time of sea shells where the single-valuedness of genotopic formulations does not assure the invariant treatment of the irreversibility of biological systems. This third method is hence presented in the monograph as being specifically applicable to these (but also to other branches of Science, e.g. Cosmology).

The powerful theories get equally strong confirmation and harvest by the exciting discovery and extraction of a new, remarkably corresponding chemical species named "Magnecules", in which atoms are bonded together into stable clusters by internal attractive forces due to the magnetic and electric polarization of their orbitals. Impressive experimental data supporting the existence and properties of Santilli's Magnecules are given.

Finally, and crowning the preceding ground achievements, Santilli describes the application of the new methods and the chemical species of Magnecules to the industrial production of a new fuel he calls "MagneGas"^{TM} and whose combustion exhaust is so clean that it has been certified that it does not require catalytic converters.

The monograph proves the viewpoint repeatedly expressed by Santilli in his works, that there cannot be really new scientific theories without really new Mathematics, and there cannot be really new Mathematics without new, and active numbers. However, there is a mutual objective study and analysis of rendered Nature, which remains the firm and unquestionable basis and where, therefore, in their proper generating, assisting and interpretative powers, "the newer concepts in mathematics" are neither the "servants" nor the "masters" [1] but the equals. Seeing that a formula does the job spurs considerations on the phenomenon exhibiting such behaviour. But it is the patient and reflective observations and explorations of Reality that conducts the designated mind to the appropriate Mathematics. That Professor Santilli, repeatedly nominated for the Nobel Prize, is extremely well equipped and capable to both ends is amply documented, first and foremost by his work, but also by the biographic and bibliographic sections of the monograph which deserve to be briefly summarised as well.

He proposed Hadronic Mechanics already in 1978 jointly with its basic Lie-admissible structure when he was at Harvard University under US Department of Energy support. The study was continued by mathematicians, theoreticians and experimentalists too numerous to quote here (but included in the book's references). However, Santilli remains to this day the most active contributor, eventually bringing the venture to full mathematical maturity in 1996, physical maturity in 1997 and geometric maturity in 1998. Among the main contributors to the novel

Hadronic Chemistry also the Physicists A.O.E. Animalu (co-work and verification on Cooper pair model) and A.K. Aringazin et al. (validation of the new Magnecule species and Chemistry), and the chemist D.D.S. Shillady (co-work on new molecular model) are prominent. No doubt many more will follow when rich, solid, convincing evidence and revenues are now accumulating of the greatest importance for Mankind in evermore desperate need of clean energies and enhanced understanding of the world.

References

1. W.M. Honig, Mathematics in Physical Science, or why the tail Wags the Dog. *Phys Essays* **13** (2000), pp. 518–519. Abstract + References in Scopus | Cited By in Scopus
2. Sturlasson S. The elder Edda.
3. Noel E. editor. Le matin des mathematiciens—Entretiens sur l'histoire des mathematiques presentes par Emile Noel. Paris: Edition Belin—Radio France, 1985.
4. Lie MS. Over en classe geometriske transformationer. Doctoral Dissertation, Christiania (now Oslo), 1871.
5. E. Trell, Marius Sophus Lie's doctoral thesis over en classe geometriske transformationer. *Algebras Groups Geom* **15** (1998), pp. 395–445.